CYPRESS–GUM SWAMP (BROWNWATER SUBTYPE)

Concept: Cypress–Gum Swamps are wet forests dominated by combinations of *Nyssa* and *Taxodium*, flooded for long periods by overbank flow from rivers or streams. The Brownwater Subtype encompasses examples along large brownwater (alluvial) rivers which receive clay-rich floodwaters and have *Nyssa aquatica* as the primary canopy hardwood species.

Distinguishing Features: The Cypress–Gum Swamp type is distinguished by canopy dominance of combinations of *Taxodium* and *Nyssa* in a nontidal river floodplain setting that is not impounded. The distinction from Tidal Swamp (Cypress–Gum Subtype) can be subtle on the edges of tidal influence and where tidal flooding is primarily from irregular wind tides. However, *Morella cerifera, Juniperus silicicola,* and many herbs associated with Tidal Freshwater Marsh communities are good indicators of tidal conditions. Tidal swamps usually have a more open canopy created by stress from rising sea level, but this is not always the case.

Nonriverine Swamp Forests may also resemble Cypress–Gum Swamps, and the distinction may occasionally be subtle. Nonriverine conditions are marked by a substantial component of acid-loving understory and shrub species typical of pocosins, such as *Persea palustris, Magnolia virginiana, Lyonia lucida, Leucothoe axillaris,* and *Clethra alnifolia*.

Coastal Plain Semipermanent Impoundment (Cypress–Gum Subtype) is distinguished from Cypress–Gum Swamp by the presence of impounded water that does not drain with the fall of floods. This is generally marked by the loss of all but the most water-tolerant species, or by their confinement to elevated microsites such as tree bases. Floating aquatic plants often are present. The canopy generally is somewhat open in Semipermanent Impoundments.

The Brownwater Subtype is distinguished from the other subtypes by its association with brownwater rivers and by the strong dominance of *Nyssa aquatica* with only minor *Nyssa biflora* in the canopy. Backwater creeks, Coastal Plain tributaries that receive muddy water backing up from brownwater rivers as they flood, should be treated as the Brownwater Subtype if *Nyssa aquatica* is the primary hardwood.

Synonyms: *Taxodium distichum* - *Nyssa aquatica / Fraxinus caroliniana* Forest (CEGL007431). Ecological Systems: Atlantic Coastal Plain Small Brownwater River Floodplain Forest (CES203.250). Southern Atlantic Coastal Plain Large River Floodplain Forest (CES203.066).

Sites: Cypress–Gum Swamps occur in the lowest parts of floodplains, in sloughs, abandoned channel segments, overflow channels, swales, and backswamp basins. They may be present in sloughs on river terraces if they are low enough to flood frequently.

Soils: The Brownwater Subtype occurs on wet alluvial soils. Most have a higher clay content than those in the other brownwater communities, but those in overflow channels may be sandy. Most occurrences are mapped as Wehadkee (Fluvaquentic Endoaquept), Bibb (Typic Fluvaquent), Chewacla (Fluvaquentic Dystrudept), or Chastain (Typic Fluvaquent). A few areas, generally downstream, have organic soils and are mapped as Dorovan (Typic Haplosaprist).

Hydrology: Cypress–Gum Swamps are seasonally to frequently flooded. They may stay flooded well into the growing season and may be flooded again during the growing season by major storms or wet periods. While water may flow rapidly down the floodplain in major floods, in most Cypress–Gum Swamps the flood waters are stagnant for long periods. In the Brownwater Subtype, natural levees slow drainage when the river falls and prolong floods. Clay deposited in the still waters leads to impermeable soils that may perch water at the surface.

Vegetation: The Brownwater Subtype is dominated by varying combinations of *Nyssa aquatica* and *Taxodium distichum*. Most examples have at least a small amount of both, but a few may be exclusively one or the other. *Populus heterophylla* is fairly frequent and may occasionally be abundant. Other trees, such as *Acer rubrum* var. *trilobum*, *Fraxinus pennsylvanica*, and *Ulmus americana*, are present only in small numbers or in transitions to drier communities. The understory usually is dominated by *Fraxinus caroliniana*, but *Acer rubrum* var. *trilobum* may be abundant and *Acer negundo* is fairly frequent. Shrubs are sparse. *Ilex decidua, Itea virginica,* and *Cephalanthus occidentalis* are fairly frequent in plots data (Rice et al. 2001, Faestal 2012, CVS data). Woody vines are diverse and may have high cover locally but their density is fairly low. Constant or fairly frequent species are *Toxicodendron radicans, Campsis radicans, Smilax rotundifolia, Muscadinia rotundifolia, Berchemia scandens,* and *Nekemias arborea*. *Smilax walteria* is recorded less frequently but is often observed. The herb layer ranges from largely absent to locally dense in patches. *Boehmeria cylindrica* and *Saururus cernuus* are highly constant and often dominant in patches. *Carex* species, most frequently *ludoviciana, lupulina, typhina, tribuloides*, but also often *gigantea* or *crinita*, may also dominate patches. Other fairly frequent herbs in plots include *Bidens discoida, Leersia oryzoides, Commelina virginiana, Ludwigia palustris*, and the exotic *Murdannia keisak*. Less frequent but characteristic species include *Lobelia inflata, Gradiola virginiana, Leersia virginica, Persicaria hydropiperoides*, *Viola* sp., and *Pluchea camphorata*. The epiphyte *Tillandsia usneoides* may have high cover, and *Pleopeltis michauxiana* may cover trunks and branches of some trees.

Range and Abundance: Ranked G5?. Examples are abundant along all of North Carolina's brownwater rivers and can cover large areas in the middle and outer Coastal Plain portions. Because wetness prevents conversion of these forests to agriculture or pine plantation and makes logging more difficult, more examples remain in relatively natural condition than is the case for most communities.

The synonymized NVC association ranges throughout the Southeast, from Virginia to Texas, making it one of the most wide-ranging communities in the NVC. The low species richness imposed by extreme wetness limits variation, but whether the community is sufficiently uniform through such a large range, more uniform than most other communities in the region, is unclear.

Associations and Patterns: Cypress–Gum Swamps occur in mosaics with other floodplain forests. In downstream parts of rivers, they may form large patches that occupy much of the area. In the middle and inner Coastal Plain, patches may be large in backswamp basins on large rivers but otherwise are linear bands along sloughs or swales. The Brownwater Subtype usually grades to Brownwater Bottomland Hardwoods or Brownwater Levee Forest. While the Swamp Transition Subtype and the Low Levee Subtype, respectively, are conceptually the adjacent communities along the moisture gradient, they are not always recognizable. In practice, any brownwater

community may be found bordering them. Coastal Plain Semipermanent Impoundment or Oxbow Lake communities may also be interspersed. Cypress–Gum Swamp may grade downstream to Tidal Swamp.

Variation: With limited diversity of plants, examples vary primarily in the relative amounts of *Taxodium* and *Nyssa*, which may be natural or may be a result of past logging. Vegetation may vary among examples in backswamp basins, sloughs, and sandy overflow channels

Dynamics: While the dynamics of Cypress–Gum Swamps are similar to other floodplain communities, several aspects are different. Mattoon (1915) suggests reproduction is episodic and infrequent well beyond areas of permanent inundation. His observations in virgin stands found a patchy age structure, with even-aged groups making up a multi-aged stand. He reported some patches with concentric, progressively younger tree zones toward the middle. This suggests trees establishing as a basin was filled in, but he did not suggest this was the predominant means of regeneration. Any abandoned channel segments or isolated depressions in brownwater floodplains will be filled in by ongoing sediment deposition fairly quickly. Shankman (1991, 1993) suggested that all cypress regeneration was tied to channel migration in the Interior rivers he studied. This is not obviously so in North Carolina, but Stahle et al. (2012) confirmed the patchy age structure in the Blackwater Subtype in the Black River Swamp and it likely applies to the Brownwater Subtype as well. The uncommon conditions that can lead to establishment of patches of cypress in the absence of geologically-created new habitat are not well known. Both dominant trees in this community are very tolerant of wind, and wind-thrown *Taxodium* are virtually never observed. *Nyssa aquatica* too is very tolerant of wind, but canopy gaps created by the most severe storms may be important for *Taxodium* regeneration.

Taxodium distichum is highly tolerant of water and can survive even permanent flooding, but it cannot survive if its leaves are submersed. Thus, prolonged flooding prevents regeneration. In the wettest areas, seedlings may be able to establish only in unusually dry periods. In other situations, wet periods that reduce competition from other trees may be necessary.

It has been widely noted that cypress often failed to regenerate after early logging. It appears that the amount of *Taxodium* in most examples is now much less than in the past, though it is difficult to know how abundant it was and how it was distributed in the past. Broadwell (2000) emphasized that swamps logged after 1959 had good regeneration on the Roanoke River while stands logged before that did not, regardless of the logging technique or intensity. He suggested that the altered flood regime caused by dams constructed around that time is responsible, perhaps by causing longer low-level flooding that is stressful for competing trees.

Despite the wet habitat, Stahle et al. (1988) found that tree ring growth in *Taxodium* was positively related to rainfall. Stahle et al. (2012) suggested that flowing water brings oxygen and nutrients that enhance tree growth. They also noted the ability of *Taxodium* to adapt to changing water levels by producing new fine roots from trunks, knees, and upper roots at levels with good oxygenation. These fine roots can readily be seen at low water levels. They noted that this adaptation is effective enough that the tree rings are a poor indicator of longer-term water level changes even as they are a good indicator of short-term rainfall patterns.

As the lowest elevation communities in the floodplain, Cypress–Gum Swamps along downstream parts of rivers are the first to be affected by the inland spread of tidal influence with rising sea level. While the canopy initially remains the same, as saturation becomes permanent and flooding becomes more frequent, the lower strata change to those characteristic of Tidal Swamp. Over time, increasing stress leads to thinning of crowns and eventually increasing tree mortality. In the Brownwater Subtype, sediment deposition may raise the floodplain surface enough to partly offset slow sea level rise, but this is not well known.

Cypress–Gum Swamps are the most susceptible brownwater floodplain communities to impoundment by beavers. Beaver dams on sloughs can flood narrow bands or larger backswamp basins. See the discussion under Coastal Plain Semipermanent Impoundment. Because *Taxodium* and *Nyssa aquatica* can tolerate permanent flooding, the swamp canopy often survives to become the canopy of the Cypress–Gum Subtype of Coastal Plain Semipermanent Impoundment. When the beaver pond is abandoned and drains, the canopy remains, and the community quickly reverts to typical Cypress–Gum Swamp. However, the speed at which the characteristic understory and herbs return is not well known.

Comments: *Nyssa aquatica* Forest (CEGL002419), which was recognized provisionally as a Tupelo subtype in earlier 4th approximation draft, has been dropped. There is no clear way to distinguish swamps that naturally lack *Taxodium* from those that have lost it because of early logging. Virtually all examples are dominated by *Nyssa*, with *Taxodium* occurring as a minority. It is unclear if any swamp forests that naturally lacked *Taxodium* occurred in North Carolina.

Rare species:
Vascular plants: *Carex crus-corvi, Ranunculus flabellaris,* and *Sagittaria weatherbiana.*
Vertebrate animals: *Ictinia mississippiensis*. *Necturus lewisii,* and *Noturus furiosus* and other fishes can inhabit Cypress–Gum Swamps during flood periods.

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